

REMARKS

By this Amendment claims 22-36 and 40-42 have been amended to better define the invention and better comply with U.S. practice, and claims 37-39 have been canceled. Entry is requested.

In the outstanding Office Action the examiner has rejected claim 37 under 35 U.S.C. 102(b) as being anticipated by Schonfeld et al., he has rejected claims 22-39 under 35 U.S.C. 103(a) as being unpatentable over Miller et al. in view of Hallum, he has rejected claim 40 under 35 U.S.C. 103(a) as being unpatentable over Miller et al. in view of Hanson, he has rejected claims 41 and 42 under 35 U.S.C. 103(a) as being unpatentable over Schonfeld et al. in view of Hanson, and he has rejected claims 29 and 30 under 35 U.S.C. 103(a) as being unpatentable over Miller et al. in view of Hanson and Sarkar et al.

These rejections are without merit.

The examiner is reminded that in the present application the term "redox state" (which could also read as "redox status") is derived from reduction/oxidation status of, e.g., anode or catalyst materials. The term redox state thus should express to what extent the anode or catalyst material is oxidized or deoxidized or in other words to determine the degree of oxidation.

This explanation is disclosed indirectly in the description (last paragraph of page 1 to first paragraph of page 2):

"Nickel (Ni) or nickel-cermet may be used as catalyst material at the anode, but this will form nickel oxide (NiO) in contact with an atmosphere containing oxygen, and its catalytic activity will deteriorate. For this reason starting the operation of a high-temperature fuel cell with Ni or Ni-cermet as anode material requires a so-called reduction phase during which the anode space is initially flushed with nitrogen and is then subjected to the combustion gas (e.g., hydrogen), which acts as reducing agent and whose concentration is increased in a stepwise manner. During this reduction phase NiO is reduced to metallic Ni. Conversely, oxidation of the anode material cannot be avoided on certain occasions, e.g. during maintenance activities. Reduction and oxidation of the anode is referred to as the 'redox cycle'."

This means oxidation of the anode material should be avoided or reversed using a reduction phase.

Until now it was not easy to determine whether or not the anode material of a fuel cell under operating conditions is oxidized. Further, also the degree of oxidation was not measurable. That leads to the object of present invention as follows:

"...to propose a method and device as well as a sensor arrangement for the monitoring of the redox state of the anode of a high-temperature fuel cell or of the catalytic reaction surface of a reformer, which may be used during normal operation and which should furthermore ensure optimised and safe operation of the fuel cell or fuel cell assembly including the reformer, by controlling or adjusting at least one operational parameter."

The measurement of the redox status can not be performed directly on the anode material of the fuel cell during normal operation because there is not place enough for a piezoelectric element or for electrodes

which are needed for a resonator element of a piezoelectric sensor.

Further, the anode function could be obstructed if the anode material would be placed on a piezoelectric element.

The inventive idea now is to undergo the same conditions for the anode material and the remote resonator of the piezoelectric sensor, that means to contact them with the same gas flow. Then at least one change in the resonance properties, preferably the resonance frequency, of the resonator is measured and the redox state (or redox status) of the anode of the high-temperature fuel cell is inferred from this measurement.

In Miller et al. a piezoelectric sensor for hydride gases is disclosed. The sensor may be utilized for detection of hydride gases in environmental gas monitoring applications. There is no mention of phrases like "redox state", "anode", "reformer" or "fuel cell." The inventive method is based on measuring a solid-state property (redox status of a surface) whereas the device of Miller et al. is used for detection of a trace fluid component in a fluid environment.

The fuel cell system of Hallum has one ore more sensors which can detect the difference in the content of a gas (e.g., hydrogen) in an inlet and outlet stream of the fuel cell system. Again, there is no mention of a sensor system for measuring the redox status of a reaction surface of the fuel cell or a reformer.

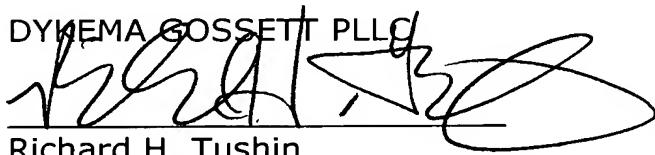
No possible combination of Miller et al. and Hallum would suggest a method for determining the redox state of an anode of a high temperature fuel cell or a reaction surface of a reformer according to the steps defined in applicant's claim 22, or with a device as defined in claim 28.

And nothing in Hanson or Schonfeld et al. would overcome this basic deficiency in the examiner's rejection of claims 22 and 28.

The examiner's prior art rejections should be withdrawn and the amended claims allowed.

Respectfully submitted,

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